Long-Term Surveillance Plan
for the
DOE Bluewater (UMTRCA Title II) Disposal Site
Near Grants, New Mexico

July 1997

Prepared for
U.S. Department of Energy
Grand Junction Office
Grand Junction, Colorado

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1.0 Introduction

1.1 Purpose

This Long-Term Surveillance Plan (LTSP) is a technical plan that explains how the U.S. Department of Energy (DOE) will fulfill general license requirements of 10 CFR 40.28 as long-term custodian of the Bluewater uranium mill site (Bluewater site), near Grants, New Mexico, formerly owned by Atlantic Richfield Company (ARCO).

1.2 Legal and Regulatory Requirements

The Uranium Mill Tailings Radiation Control Act (UMTRCA) of 1978 (42 USC § 7901) as amended, provides for reclamation and regulation of uranium mill tailings at two categories of mill tailings sites, Title I and Title II. Title I includes former uranium mill sites that were unlicensed, as of January 1, 1978, and essentially abandoned. Title II includes uranium milling sites under specific license as of January 1, 1978. In both cases, the licensing agency is the U.S. Nuclear Regulatory Commission (NRC), or in the case of certain Title II disposal sites, an Agreement State. The Bluewater site is a Title II site under UMTRCA. The State of New Mexico is not an Agreement State.

Federal regulations at 10 CFR 40.28 provide for the licensing, custody, and long-term care of uranium and thorium mill tailings sites closed under Title II of UMTRCA.

> A general license is issued (to the DOE by the NRC) for the custody of and long-term care, including monitoring, maintenance, and emergency measures necessary to protect the public health and safety and other actions necessary to comply with the standards in this part for uranium or thorium mill tailings sites...The purpose of this general license is to ensure that uranium and thorium mill tailings disposal sites will be cared for in such a manner as to protect the public health, safety, and the environment after closure.

The general (long-term custody) license becomes effective when the current specific license is terminated by the NRC or an Agreement State, and when a site-specific LTSP, this document, is accepted by the NRC.

Requirements of the LTSP and general requirements for the long-term custody and care of the Bluewater site are addressed in various sections of the LTSP (Table 1–1).

Table 1–1. Requirements of LTSP and for Long-Term Custodian (DOE) of Bluewater Site

Requirements of LTSP	
Requirement	**Location**
1 Legal description of site	Section 2.1
2. Description of final site conditions	Sections 2.3, 2.4, 2.5, and 2.6
3. Description of the long-term surveillance program	Section 3.0
4. Criteria for follow-up inspections	Section 3.5.1
5. Criteria for maintenance and emergency measures	Section 3.6

Requirements for Long-Term Custodian (DOE)	
Requirement	**Location**
1. Notification to NRC of changes to the LTSP	Section 3.1
2. NRC permanent right-of-entry	Section 3.1
3. Notification to NRC of significant construction, actions, or repairs at the site	Sections 3.5 and 3.6

1.3 Role of the Department of Energy

In 1988, the DOE designated the Grand Junction Office (GJO) to be the program office for long-term surveillance and maintenance of all DOE remedial action project disposal sites, as well as other sites (including Title II sites) as assigned, and to establish a common office for the security, surveillance, monitoring, and maintenance of these sites. The DOE established the Long-Term Surveillance and Maintenance (LTSM) Program at the GJO to carry out this responsibility.

The LTSM Program is responsible for the preparation, revision, and implementation of this LTSP, which includes site inspection, monitoring, and maintenance. The LTSM Program is also responsible for annual and other reporting requirements and for maintaining records pertaining to the site.

1.4 Disposal of Mill Waste Containing Polychlorinated Biphenyls

During reclamation of the Bluewater uranium mill site, ARCO discovered some wastes composed primarily of spillage of ore residues from the mill ore crushing and milling circuit and polychlorinated biphenyls (PCBs) from electrical transformers in or adjacent to the mill. At the time of the discovery of the waste, there were no commercial waste disposal sites in the United States licensed to accept radioactive waste contaminated with PCBs.

ARCO requested NRC approval of the disposal of the PCB-contaminated mill waste at the Bluewater site. The presence of the PCBs made the waste subject to regulation under the Toxic Substances Control Act (TSCA), which is under the jurisdiction of the U.S. Environmental Protection Agency (EPA). Therefore, EPA approval would also be necessary. Additionally, the disposal of the PCB-contaminated material also required the concurrence of the DOE, as the long-term custodian.

ARCO conducted both a hydrologic evaluation and a risk assessment of its proposed PCB-byproduct disposal approach (ARCO 1996c and ARCO 1996f, respectively). Additionally, ARCO developed a monitoring plan for the proposed PCB disposal facility (ARCO 1996e).

The DOE concurred with the disposal subject to an indemnification agreement with ARCO whereby ARCO agreed to cover future costs that may be associated with or result from the PCB disposal. This indemnification agreement is included in this document as Appendix G. The DOE also required ARCO to cover the costs of the additional ground-water monitoring necessary because of the disposal of PCBs at the site.

The EPA agreed to permit the proposed disposal approach, provided that the ground-water monitoring, as described in the monitoring plan (ARCO 1996e) was conducted and the appropriate records maintained.

Finally, the NRC granted a license amendment (amendment 33) to ARCO allowing the disposal of the PCB-contaminated materials at the Bluewater site. Copies of the NRC, EPA, and DOE approval correspondence for the PCB disposal are also included as attachments to the indemnification agreement in Appendix G.

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2.0 Bluewater Disposal Site

2.1 Description of Site Area

2.1.1 Location and Property Ownership

The Bluewater site is in the north-central part of Cibola (formerly Valencia) County in west-central New Mexico. The site is about 9 air miles (mi) (15 kilometers [km]) northwest of Grants, the county seat, and about 1.5 mi (2.4 km) northeast of the village of Bluewater. Between the village of Bluewater and the site is the transportation corridor containing Interstate 40, State Highway 122 (old U.S. Highway 66), and the main line of the Atchison, Topeka, and Santa Fe (AT&SF) Railroad. The location of the site is shown in Figure 2–1.

The Bluewater site at 35° 15–17' N and 107° 55–57' W is in the broad northwest-trending Grants-Bluewater Valley, which contains the southeasterly flowing Rio San Jose (Figure 2–1). The site property boundary is in the south-central part of the U.S. Geological Survey Bluewater 1:24,000-scale topographic map. The site encompasses approximately 3,300 acres (1,330 hectares [ha]) and is in Sections 7, 8, 17, 18, and 19, Township (T) 12 North (N), Range (R) 10 West (W), and in Sections 12, 13, and 24, T 12 N, R 11 W, New Mexico Principal Meridian. A legal description of the site property boundary is given in Appendix A. All real estate correspondence and instruments are maintained and filed by the Property Management Branch, DOE Albuquerque Operations Office. Access directions to the site from the Grants-Milan area to the southeast are shown in Table 2–1.

Table 2–1. Directions and Mileage from Albuquerque to Site

Mileage	Route
0.0	After traveling west approximately 80 mi (130 km) from Albuquerque on Interstate 40, take Exit 79 (Milan and San Mateo). At the bottom of the exit ramp, turn right, and proceed northeast on Horizon Avenue.
0.1	Stop. Turn left (northwest) on State Highway 122 (old U.S. Highway 66).
0.3	State Highway 605 to right goes to San Mateo and Ambrosia Lake; continue ahead on State Highway 122.
2.6	State Highway 568 to left; continue ahead.
5.5	Turn right on paved road (turnoff for former ARCO Bluewater Mill).
5.6	Pass under railroad tracks.
6.1	Junction with dirt road (State Highway 334) to right. Turn right and proceed eastward.
7.1	Site entrance gate to left (north) along power line easement.

Principal land uses in areas adjacent and near the site are described in the *Land Use Survey Report* (ARCO 1995b). These land uses are agriculture (limited irrigated farming and cattle grazing), small businesses along Interstate 40 and in the village of Bluewater, and residential (village of Bluewater and scattered single residences). The economy of the area is characterized in the *Final Socioeconomic Report* *for Bluewater Uranium Mill Vicinity* (Dames and Moore 1989) and is based in ranching, alfalfa and hay production, tourism, and retirement. Land ownership in the vicinity of the site is varied and is a

Figure 2–1. Location of Bluewater, New Mexico, Site checkerboard of State, Federal (Bureau of Land Management and Forest Service), private, and Indian lands. Several utility company pipelines and transmission lines and their associated right-of-ways cross the site property. The site property boundary, adjacent landowners, and utility company right-of-ways across the site property are shown in Figure 2–2. Names, addresses, and phone numbers for the adjacent landowners and utility companies owning the right-of-way easements are given in Appendix B.

The site property is enclosed by a 4-strand barbed-wire fence that meets highway fence specifications. Steel T-posts are set on 16 ft (5 m) centers. The site entrance gate is at the southeast corner of the site along State Highway 334 (Figures 2–1 and 2–2). The site access road goes north from the gate along a DOE property easement about 0.25 mi (0.4 km) long to reach the main site property. No prior notification or permission from property owners adjacent to the site is necessary for access to the site. The entrance gate is locked and a key is held by the DOE–GJO Project Manager, who should be contacted for access to the site (Table 2–2).

Table 2–2. Bluewater Site Key Holder

Title and current contact	Telephone	Address
DOE–GJO Project Manager (Joe Virgona)	(970) 248–6006	U.S. Department of Energy 2597 B 3/4 Road Grand Junction, CO 81503

The fenced property boundary (site perimeter) is approximately 9.5 mi (15 km) long. Ground survey and aerial photography indicate that vehicle tracks and old roads approach the site from several directions and at several places other than the official entrance. It is the DOE's intention to discourage use of these roads. The perimeter fence has gates only at the site entrance and at locations where utility and pipeline easements cross the site boundary. Access gates to easements will be double locked for dual access. The DOE's lock is keyed the same as the lock at the official entrance.

Several utility company right-of-ways pass across the site property (Figure 2–2). The legal description of each utility company right-of-way across the property is given in Appendix C. These right-of-way corridors are delineated by stock fence where they pass across the site property. Where each right-of-way intersects the site property fence, a vehicle access gate has been constructed in the site property fence. These gates are locked and a key to each lock is kept by the appropriate utility company. Where access roads inside the site property intersect a utility company right-of-way, two vehicle access gates have been constructed to allow travel across the right-of-ways. Gates at these crossings are locked and have the same key as the entrance gate. The Plains Electric Generation and Transmission Cooperative, Inc., in addition to its power line right-of-way, also has a tract 330 by 660 ft (100 by 200 m) that contains a power transformer station along its right-of-way in the south part of the site. The legal description of this tract is given in Appendix C. A chain-link fence about 7 ft (2.2 m) high has been constructed on the boundary of the power transformer station property tract.

Warning signs are posted at various places around the site property: at the entrance gate, other vehicle access gates, and around the tailings piles and other disposal areas. These warning signs inform the public of the name, function, and ownership of the site (Section 2.6). The signs are attached at a height of about 5 ft (1.5 m) above ground to 2.5-inch (in.) (5.5 centimeters [cm]) diameter pipe (posts) set in concrete. Sign posts are placed approximately 5 ft (1.5 m) inside the fence when set along the site perimeter. Warning signs are similarly placed on posts around the main tailings area, the carbonate tailings area, and other disposal areas. These signs are placed no more than 500 ft (152 m) apart and about 100 ft (31 m)

Figure 2–2. Bluewater, New Mexico, Site Property, Adjacent Landowners, and Utility Company Right-of-Ways from the edge of each radioactive material disposal area. These warning signs provide sufficient warning to persons approaching the areas of buried radioactive material. Human intrusion and vandalism are expected to be minor because of the remoteness of the site, sparse population of the area, and land use (mainly cattle grazing) of surrounding land. Additional security is considered unnecessary.

2.1.2 Topography and Geology

The Bluewater site is in the Acoma-Zuni section of the southeast part of the Colorado Plateau physiographic province. Elevation of the site ranges from approximately 6,555 ft (1,999 m) in the east-central part of the site to approximately 6,770 ft (2,065 m) in the northeast part of the site where a northwest-striking mesa slope bounds the site. Most of the site is near 6,600 ft (2,013 m) in elevation and local relief is usually less than 100 ft (31 m). The Zuni Mountains, which reach an elevation of about 9,000 ft (2,750 m), flank the Grants-Bluewater Valley to the southwest. About 15 to 20 mi (24 to 32 km) east of the site are the San Mateo Mountains, which reach an elevation of up to about 11,300 ft (3,450 m) at Mount Taylor.

A basalt flow covers part of the western and southern portions of the site. Topography in the basalt flow area is rough and irregular in places, local relief can be up to 40 ft (12 m), and numerous closed depressions occur on the surface. The rough surface of basalt flows in this area is referred to as "the malpais." Much of the remainder of the site area is flat to gently sloping and is covered by fine-grained alluvial and eolian material. Bedrock of sandstone, siltstone, and limestone is exposed in two small areas north and east of the main tailings pile where these rocks dip gently north to northeasterly and form cuestas about 75 ft (23 m) high.

Surface drainage of the site outside of the main tailings area is poorly defined where basalt is bedrock. The area underlain by basalt is in the southern and western parts of the site and is characterized by irregular topography with no developed drainage pattern. Drainage from the main tailings pile is generally northward from the crest of the pile. Surface drainage from the main tailings pile and other tailings and disposal areas is shown in Figure 2–3 (ARCO 1996a). In the area of the former evaporation ponds northeast of the main tailings pile, a channel was constructed (Figure 2–4) to drain water to the southeast away from the tailings disposal areas (ARCO 1996a). North and east of the main tailings pile and east of the area covered by basalt, drainage on alluvium and sedimentary rocks is toward the south or southwest. Eventually, this drainage direction turns toward the southeast in the area east of the limestone hills east of the main tailings pile and generally follows the gentle gradient of the southeast-draining Grants-Bluewater Valley.

Soils in the site area are generally classified as two types, Viuda-Penistaja and Penistaja-San Mateo-Sparank, according to the *Soil Survey of Cibola Area, New Mexico, Parts of Cibola, McKinley, and Valencia Counties* (Parham 1993). Viuda-Penistaja soils are in the mill site and southwest part of the site and are developed on basalt. Viuda soil is shallow, well-drained, and on hills and ridges. Penistaja soil is deep, is well-drained, and is in valleys between basalt ridges. Penistaja-San Mateo-Sparank soils are mainly in the eastern part of the site on alluvial material developed over sandstone and siltstone bedrock; soils are deep, well-drained, and are moderately susceptible to erosion by wind. The mapped distribution of these soil types for the site area is shown on sheet 5 of the Soil Survey (Parham 1993).

Geology of the Bluewater site is shown in Figure 2–5, which has been compiled and modified from the *Geologic Map of the Bluewater Quadrangle, Valencia and McKinley Counties, New Mexico* (Thaden and Ostling 1967) and from the geologic map, Plate 1, in *Geology and Ground-Water Resources of the Grants-Bluewater Area, Valencia County, New Mexico* (Gordon 1961). The following discussion of

Figure 2–3. Surface Drainage from Tailings Piles and Other Disposal Areas

Figure 2–4. Drainage Channel in Former Evaporation Ponds Area

Figure 2–5. Geologic Map of Bluewater, New Mexico, Site geologic conditions at the site is summarized mainly from the section on "Geology and Geoseismicity" in Volume II of *Licensing Documentation* prepared by Dames and Moore (ARCO 1981).

The site in the western part of the Grants-Bluewater Valley is on the northeast flank of the Zuni uplift, a northwest-trending elliptical dome. Sedimentary bedrock of Paleozoic and Mesozoic age in the site area dips generally 2 to 5 degrees to the northeast and forms a series of cuestas away from the Zuni uplift. Geologic formations exposed at the site or that influence ground-water movement in the shallow subsurface include the Glorieta Sandstone and San Andres Limestone of Permian age and the Moenkopi and Chinle Formations of Triassic age. The Glorieta Sandstone and overlying San Andres Limestone are marine and near shore marine deposits and are considered as one hydrologic unit, the San Andres aquifer. The Glorieta is composed mainly of buff to white medium-grained sandstone; upper sandstones in the formation are calcareous and grade into limestones of the overlying San Andres Limestone. The San Andres Limestone is about 115 ft (35 m) thick, is composed of limestone and sandstone, and consists of three parts. The lower part is about 20 ft (6 m) thick and consists of dense gray limestone. The middle part is about 15 ft (5 m) thick and consists of yellow, medium- to fine-grained sandstone. The upper part, which is the only part of the formation exposed at the site (and the oldest formation exposed at the site), is about 80 ft (25 m) thick and consists of gray-yellow and brown to red dense limestone interbedded with yellow, fine- to medium-grained sandstone. The hill about 70 ft (22 m) high that is southeast of the main tailings pile is formed on San Andres Limestone. Karst developed on the uppermost surface and in the upper part of the San Andres, which is unconformably overlain by the thin Moenkopi Formation of Triassic age. Erosional relief developed on the San Andres prior to deposition of the Moenkopi is estimated to be 10 ft (3 m) or less at the site (ARCO 1981).

The red outcrops on the north side of the San Andres Limestone hill are formed by the Moenkopi Formation (Figure 2–5), which is composed of red-brown and gray-red arkosic and micaceous sandstone interbedded with pebble conglomerate and mudstone galls. A thickness of only about 26 ft (8 m) of the Moenkopi is present; this is the only exposure of the formation on the site. Unconformably overlying the Moenkopi is the thick Chinle Formation, which crops out mainly on the sides of mesas (cuestas) in the extreme northwest and northeast parts of the site (Figure 2–5). The Chinle outcrops in the extreme northwest and northeast parts of the site are of the Sonsela Sandstone Bed of the Petrified Forest Member of the Chinle, which consists of white, yellow-brown, and brown conglomeratic sandstone. Rocks of the Sonsela Bed are about 300 ft (92 m) above the base of the Chinle Formation. The lowermost rocks of the Chinle consist of clayey and sandy siltstone interbedded with lenticular conglomeratic sandstone. These rocks are mostly nonresistant and are covered by alluvial material or dune sand. The only exposure of these lower Chinle rocks is in a small area referred to as "White Rock" in the southeast quarter of Section 7 and the southwest quarter of Section 8 (Figure 2–5).

Much of the main tailings pile and approximately one-third of the site (in the southern and western parts) is underlain by basalt. The basalt consists of several flows that originated at a cinder cone, El Tintero, about 5 mi (8 km) north of the site. Basalt flows from this source have been named the Bluewater flows by Nichols (1934), and they may be as young as only 2,000 to 4,000 years old. The basalt flows appear to have flowed south and southeast and filled the ancestral drainage channel of the Rio San Jose. The flows continued to about 4 mi (6.5 km) southeast of the site; the basalt quarry in Section 27, T12N, R10W, that supplied cover rock for the tailings pile is near the end of the flows. Thickness of the basalt is typically 80 to 100 ft (22 to 31 m) but can be as much as 130 ft (40 m). Texture of the basalt varies from dense to vesicular, and the surface is usually vesicular and rough which produces a malpais-type topography.

Alluvium and eolian deposits cover more than one-third of the surface of the site. In Quaternary time prior to emplacement of the basalt flows, alluvial material accumulated along the course of the Rio San Jose. This material consists mainly of coarse sand and gravel and is present in thicknesses of up to 30 ft (9 m) beneath the Bluewater basalt flows. North and northeast of the mill site and main tailings pile, alluvial material is up to 60 ft (18 m) thick and is composed mainly of fine sand and silt with interbedded clay units. Eolian material occurs as a thin veneer over much of the surface of the site and it also occurs as interbeds in the alluvial material. One small area of dune sand occurs on the site in the southwest quarter of Section 8 on the lee side of White Rock (Figure 2–5).

Several faults and two folds are present in the site area and are shown in Figure 2–5. These structures are those shown in Plate 1 of the "Geology and Geoseismicity" section of Volume II, *Licensing Documentation*, prepared by Dames and Moore (ARCO 1981). A field investigation by Dames and Moore evaluated the numerous faults mapped by Thaden and Ostling (1967) in the site area. Faults that were verified during the investigation are not exposed at the surface of the site and are shown in Figure 2–5. The faults are normal faults, trend in northerly and easterly directions, have displacements that range from several tens of feet to several hundred feet, are related to the uplift of the nearby Zuni Mountains, and along with associated folds, are probably of middle Tertiary age (Hunt 1936).

The most significant structural feature at the site is an easterly trending fault just south of the main tailings pile and San Andres Limestone hill (Figure 2–5) that has a displacement of about 370 ft (115 m) in the area of the main tailings pile (ARCO 1981). Displacement along this fault decreases to approximately 270 ft (80 m) about 6,000 ft (1,830 m) east of the main tailings pile. Geomorphic expression of this fault is the south-facing escarpment of the San Andres Limestone hill east of the main tailings pile that extends for approximately 1 mi (1.6 km). Just south of the hill, alluvial material and Bluewater Basalt flows cover the fault; however, in the subsurface, San Andres Limestone and Glorieta Sandstone are juxtaposed against the Moenkopi and Chinle Formations to the south. In the document prepared by Dames and Moore on "Geology and Geoseismicity" (ARCO 1981) two geologic cross sections are identified that are oriented north-northeast parallel to the regional dip of the bedrock formations and extend from the fault to the south to the slopes of the mesa bordering the site to the north.

Two north-trending fold structures occur in the west part of the site in the main tailings pile area (Figure 2–5). These folds, a syncline to the west and anticline to the east, both plunge northward and probably formed from drag adjacent to the normal fault that is situated between them.

2.1.3 Climate and Vegetation

The climate at the Bluewater site is semiarid. The average annual precipitation at the site is estimated to be about 11 in. (28 cm) or slightly more than the 10.3 in. (26 cm) annual precipitation at Grants, which is slightly lower in elevation (Parham 1993). Approximately 60 percent of precipitation occurs in summer and early fall (July through mid September) during brief, sometimes heavy, thunderstorms occasionally accompanied by hail and strong, gusty winds. This moisture is from the Gulf of Mexico and is borne by southeast winds. Lightest precipitation is in the fall, winter, and spring (October through May) when most of the moisture that comes from Pacific storms falls in the mountains to the west of New Mexico. As a result, snowfall is light and the average winter total is only about 17 in. (43 cm). A snowfall of greater than 6 in. (15 cm) in one storm is unusual.

Humidity is usually low and the annual evaporation is about 60 in. (150 cm). Winds are most frequently from the west, and spring is the windiest season with March having the highest average wind speed. Diurnal temperature range is large and averages 30 to 35 °F (17 to 19 °C). Extreme high temperatures in summer can reach up to 100 °F (30 °C) and winter extreme lows can be as cold as –30 °F (–34 °C). Summer high and low temperatures are commonly in the 80s °F and 50s °F, respectively. Winter high and low temperatures are commonly in the 40s °F and teens °F, respectively.

The semiarid site conditions support sparse grassland and woodland vegetation. Most of the site is grassland dominated by blue grama and galeta grasses. Also present in the grassland is alkali sacaton, shadscale, fourwing saltbush, western wheatgrass, and rabbitbrush. Woodland vegetation is minor and consists of scattered individuals of one-seed juniper.

2.2 Site History

The original Bluewater carbonate-leach uranium mill was constructed by Anaconda Copper Mining Company to process ore from the nearby mines in Todilto Limestone. The mill began operations in October 1953 with a capacity of 300 tons of ore per day; by March 1955 the mill capacity was expanded to 1,200 tons per day. Tailings disposal from this carbonate process was in natural depressions in the basalt-flow surface just northeast of the mill site.

Discovery of sandstone uranium ores and development of the Jackpile and Paguate mines resulted in construction of an acid leach mill with a capacity after completion in December 1955 of 2,000 tons of ore per day. Tailings from the acid leach process were placed in a natural basin area north of the carbonate tailings, and dikes were constructed on the northern, eastern, southern, and southwestern boundaries of what presently is the main tailings pile. In 1957, a northwestern dike was constructed to fully contain the tailings. Prior to that time, the tailings that had drained northward beyond the dike were called the old acid tailings. The dikes around the main tailings pile were raised several times to increase the capacity of the tailings area. The various areas around the site where tailings were deposited are shown in Figure 2–6.

In May 1959, the carbonate leach mill was closed and the acid mill capacity was reduced for economic reasons. In December 1967, the acid leach mill resumed full production, which continued until August 1980. In November 1978, the capacity of the acid leach mill was increased to 6,000 tons per day. Milling operations ended at the site on February 14, 1982.

Migration of contaminated mill process water from the main tailings pile into the principal aquifer (San Andres Limestone) had become a problem by the late 1950s. After much research regarding acceptable effluent disposal methods, the Anaconda Company began deep underground disposal. A disposal well about 1 mi (1.6 km) northeast of the main tailings pile (Figure 2–6) was drilled, tested, and developed in 1959 and 1960. The well was cored to a depth of approximately 2,500 ft (770 m) and, from test data, sandstone of the Yeso Formation of Permian age from depths of 950 to 1,423 ft (289.8 to 434 m) was selected to accept the injected effluent. Details of the well drilling, coring, and analysis are in the U.S. Geological Survey Professional Paper 386–D by West (1972). Fluid disposal by injection into this well began in December 1960 and continued until late 1977 at a rate of 200 to 400 gallons (750 to 1500 liters) per minute. A filtration system was used to control the uranium concentration to less than 5 parts per million. ARCO abandoned and plugged the disposal well in October 1995 in accordance with regulations and requirements of the State Engineer and the New Mexico Water Quality Control Commission. The plugging and abandonment procedure used for the injection well are given in section 4.17 of the Completion Report (ARCO 1996). After liquid disposal by well injection ceased, seven synthetically lined evaporation ponds covering about 300 acres (120 ha) were constructed to the north and northeast of the main tailings pile (Figure 2–6) to contain the liquid effluent from the milling process. After milling operations ended, dewatering of the main tailings pile began and continued until September 1985. Wells were installed in the sands portion of the tailings, and tailings liquids were pumped back to the mill where dissolved uranium was removed by solvent extraction. The barren raffinate was at first pumped back to the main tailings pile and distributed, but from November 1983 to September 1985, it was pumped directly to the evaporation ponds.

The Atomic Energy Commission was the first to regulate the Bluewater mill. Later, the State of New Mexico regulated the mill activities under authority of Section 274 of the Atomic Energy Act of 1954. The

Figure 2–6. Tailings Piles and Other Disposal Areas at Bluewater, New Mexico, Site

State relinquished this authority in June 1986, at which time the NRC, Region IV, assumed regulatory authority. The site came under Title II of UMTRCA, after passage of the Act in 1978, and subsequent rule-making by the NRC, beginning in 1988.

From March 1981 to 1984, Anaconda submitted technical licensing documents to the New Mexico Environmental Improvement Division to support various licensing actions. These numerous technical documents consisted of tailings reclamation designs, environmental settings and analyses, and assessments of environmental impacts; all these documents are available in the site file. Together, these multiple-volume technical documents are considered an Environmental Report (ER) by the NRC. In 1984, the ER supported a license renewal application and mill modification proposal. This application was approved as was the mill modification; however, milling operations never resumed, and in 1985 Anaconda ceased operations and began to decommission the mill.

In January 1986, Anaconda changed its name to ARCO Coal Company and later that year, the NRC assumed regulatory authority over the site. In 1987, houses were removed from the old Anaconda housing area south of the mill site (Figure 2–1). In November 1986, ARCO submitted a Reclamation Plan for the mill facilities to the NRC for review and approval. In early 1989, while the Reclamation Plan was undergoing NRC review, the NRC revised its slope stabilization and rock specifications, which in turn required modifications to the Plan. ARCO revised the *Reclamation Plan, Bluewater Mill* and resubmitted the three-volume Plan to the NRC in March 1990 (ARCO 1990b). The NRC approved the Reclamation Plan in August 1990.

In December 1987, ARCO submitted a Decommissioning Plan for the Bluewater mill to the NRC for approval. Included as Appendix 1 in the Decommissioning Plan (ARCO 1987) is a report on *Radiological Characterization of the Bluewater Uranium Millsite* completed by Roy F. Weston, Inc., in October 1987. The Decommissioning Plan was approved by the NRC in September 1989, and ARCO commenced demolition of the facility. Decommissioning, which was completed in January 1991, involved demolition, disposal or decontamination, and salvage of all structures and equipment from designated areas in the mill site. Unsalvageable material was buried in three disposal cells located on site in and near the carbonate tailings pile (Figure 2–6). Details of the composition and plan and profile structure of each of the disposal cells are presented in the *Bluewater Mill Decommissioning Report* prepared by ARCO (1991b), which was submitted to the NRC for approval in March 1991. The Decommissioning Report was approved by the NRC in June 1991.

After NRC approval of the Reclamation Plan, reclamation began in January 1991. From then until August 1992, windblown tailings and residues from four of the seven evaporation ponds were removed, placed, and compacted on the slimes portion of the main tailings pile in accordance with the Reclamation Plan. Approximately a 210-acre (85 ha) area of windblown tailings on the malpais surface could not be reclaimed because the rough, hard surface of the basalt made reclamation impractical. A total of about 623,000 cubic yards (yd^3) (480,000 cubic meters [m^3]) of windblown contaminated material were excavated; details of the windblown tailings reclamation are presented in the *Windblown Contamination Cleanup Report* completed by ARCO (1992a) in October 1992.

In October 1992, the NRC requested that ARCO prepare and submit a new or supplemental ER for the site. In April 1993, ARCO submitted to the NRC a *Supplement to Environmental Report for Decommissioning and Reclamation of the Bluewater Uranium Mill* (Environmental Restoration Group, Inc. 1993).

After milling activity, ground-water protection standards for uranium, selenium, and molybdenum were exceeded at points of compliance monitor wells near the main tailings pile. The NRC required ARCO to prepare a ground-water Corrective Action Program (CAP) with the objective of returning uranium, selenium, and molybdenum to the legislated protection standards. In May 1989, ARCO submitted a CAP and an Alternative Concentration Limit (ACL) petition to the NRC; in the CAP, ARCO proposed using a wicks-and-drain system to reduce contaminant seepage during reclamation. After review, NRC required that ARCO submit a revised CAP in which several existing wells with elevated levels of hazardous constituents would be pumped to reduce hazardous constituent concentrations in the aquifer. In August 1989, ARCO submitted to NRC a revised CAP in which pumping wells would be used. NRC approved the CAP and ARCO began implementing the CAP.

Statistical evaluation by ARCO in May 1990 indicated that there was no significant reduction of hazardous constituents in the ground water as a result of pumping. Therefore, with NRC concurrence, in June 1990 ARCO submitted to NRC *the Corrective Action Program and Alternative Concentration Limits Petition for Uranium, Molybdenum, and Selenium, Bluewater Mill Near Grants, New Mexico* (ARCO 1990a). In October 1992, the NRC requested that ARCO submit a supplemental CAP that described ongoing and future corrective actions regarding removal of hazardous ground-water constituents or treating them in place. In November 1992, ARCO responded by submitting to the NRC for its approval *the Supplemental Ground Water Corrective Action Program, Bluewater Uranium Mill near Grants, New Mexico* (ARCO 1992b). The NRC responded in November 1990 to the ARCO ACL petition and requested that ARCO propose Points of Exposure (POEs) adjacent to the future restricted area (within the area to be transferred to the DOE following closure). In response, ARCO submitted to NRC in August 1991, *the Alternate Concentration Limits Petition Addendum for Bluewater Uranium Mill Near Grants, New Mexico* (ARCO 1991a) in which ACLs were revised based on an analysis of POEs at the future government property boundary.

The NRC completed its review of ARCO's ACL petition, supplements, and addendums in January 1995. The review was based on guidelines and criteria from the *Alternate Concentration Limits for Title II Uranium Mills* draft final staff technical position (NRC 1994). The review resulted in seven open issues that were resolved by ARCO in a revised ACL petition, which was completed and submitted to the NRC in April 1995 (ARCO 1995a). In February 1996, the revised ACL petition was approved by the NRC as amendment 30 to the source material license.

In May 1995, ARCO applied to the NRC for a license amendment to allow on-site disposal of radioactive waste contaminated by polychlorinated biphenyls (PCBs). The radioactive waste was soil from a uranium processing area that was contaminated by a leaking PCB electrical transformer. This waste was classified as "PCB by-product material" subject to the Toxic Substance Control Act, which is under the jurisdiction of the U.S. Environmental Protection Agency (EPA). The EPA evaluated ARCOs proposed landfill disposal method (ARCO 1996e) and granted approval. The NRC subsequently approved the PCB disposal as amendment 33 to the source material license.

Rock cover placement on the tailings piles was completed at the site in December 1995. During an NRC inspection of erosion protection rock placement at the site in June 1996, several small areas on the spillway along the north edge of the main tailings pile appeared to be lacking the proper amount of large rock on the surface. This condition of rock out of gradation was addressed by ARCO who prepared a gradation verification sampling plan to NRC. The NRC and ARCO agreed on the sampling protocol and additional rock was placed and reworked to correct the condition (ARCO 1996d).

Land survey of the DOE site property boundary was completed in the fall of 1995. Boundary monuments were set and fencing of the site perimeter and utility company right-of-ways was completed in early 1996.

2.3 Design of Tailings Piles and Other Disposal Areas

Design specifications to meet the long-term stability requirements for the various areas in the site are defined in Appendix A of the Reclamation Plan (ARCO 1990b) and in various amendments to the site license. Design requirements also used for reclamation at the site are in 10 CFR Part 40, Appendix A.

Reclaimed areas at the site shown in Figure 2–6 consist mainly of the main tailings pile (and the adjacent acid tailings pile and south bench) and the carbonate tailings pile (includes disposal areas no. 2 and no. 3). Other reclaimed areas include the plant site, ore stockpile area, disposal area no. 1, landfills, asbestos disposal area, and the PCB disposal area. Design specifications for these reclaimed areas are summarized in the Completion Report, Table 4.3.2 (ARCO 1996a). Key elements of the design of the main tailings pile, carbonate tailings pile, and other disposal areas are included in the following sections. Design details for these areas are in the Reclamation Plan (ARCO 1990b) and the Completion Report (ARCO 1996a).

2.3.1 Main Tailings Pile

The main tailings pile was the principal repository for tailings generated from the acid leach circuit of the mill. Heavier, more coarse sand material was deposited near the south end of the pile and liquids and finer materials flowed to the north side. Total reclaimed area, including outslopes, is about 320 acres (129 ha). The final configuration of the pile is shown in Figure 2–7 and a typical cross section is shown in Figure 2–8. Average thicknesses of the radon cover on the sands tailings, slopes, and spillway are 3.2, 3.4, and 2.4 ft (97, 102, and 73 cm), respectively. Rock erosion protection cover on the top surface of the pile is 4.5 in. (11 cm) thick of D_{50} = 1.5 in. (4 cm) rock. Cover rock on the outslopes is 7.5 in. (19 cm) thick of D_{50} = 2.5 in. (6 cm) rock and on the spillways is 12 in. (30 cm) thick of D_{50} = 5 in. (13 cm) rock.

The acid pile (Figure 2–7) along the northwest edge of the main tailings pile contained tailings from the acid leach process that, prior to 1957, were allowed to flow northwest from the main tailings pile. The final top slope of the acid pile is relatively flat (slopes 0.15 percent northward) and is covered by 8 in. (20 cm) of topsoil, which has been seeded with native grasses. The topsoil is underlain by an 8 in.(20 cm) average thickness of radon cover material. The short outslope along the north side of the acid pile is covered by riprap about 7.5 in. (19 cm) thick of D_{50} = 2.5 in. (6 cm).

The south bench (Figure 2–7) is a narrow embankment that extends south from the main tailings pile to include additional tailings. The top slope of the bench slopes gently southward at 0.15 percent and is covered by 8 in. (20 cm) of topsoil seeded with native grasses. The topsoil and underlying radon barrier material combine to provide an average radon cover thickness of 3.4 ft (102 cm). At the east base of the south bench, a drainage channel was excavated into bedrock to allow runoff from the hillside to the north and east to drain southward away from the main tailings pile. This channel was covered with a 12 in. (30 cm) thickness of D_{50} = 5 in. (13 cm) riprap.

2.3.2 Carbonate Tailings Pile

The carbonate tailings pile contains tailings generated from the carbonate leach process that were deposited just northeast of the plant site from 1953 to late 1955. The carbonate pile shown in Figure 2–9 includes disposal areas no. 2 and no. 3, both of which were used for disposal of mill building debris, evaporation pond liner, and other rubble. Disposal area no. 2 is in the south part of the carbonate pile and disposal area no. 3 is in the southwest part of the pile. A typical cross section through the carbonate pile is shown in Figure 2–10.

Figure 2–7. Main Tailings Pile Area

Figure 2–8. Cross Section of Main Tailings Pile

Figure 2–9. Carbonate Tailings Pile

Figure 2–10. Cross Section of Carbonate Tailings Pile

pile—from 3.5 to 4 ft (1.1 to 1.2 m) in the main part of the pile to 2 ft (0.6 m) in disposal area no. 2 and 2.4 ft (0.7 m) in disposal area no. 3.

2.3.3 Other Disposal Areas

The other disposal areas are shown in Figure 2–6, and more detailed maps of these areas are in the Completion Report (ARCO 1996a). The plant site area surface was smoothed to cover foundations and fill sumps, covered by an average thickness of 15 in. (38 cm) of compacted engineered fill, and overlain by 8 in. (20 cm) of topsoil, which was seeded with native grasses.

The ore stockpile area covers an area of about 45 acres (18 ha) in two levels east of the plant site. The lower of the two levels to the north was used for storage of used plant equipment. The upper and larger area was used for ore storage; the ore was removed but the porous basalt contains residual radioactivity that could not be removed. The narrow slope that separates the two levels of the area was covered by basalt riprap with the same specifications as the outslopes of the main tailings pile. A compacted engineered cover 12 in. (30 cm) thick was placed over the surface of the stockpile area; this material was overlain by 8 in. (20 cm) of topsoil, which was seeded with native grasses.

Two landfills, each about one acre (0.4 ha) in size, east of the carbonate tailings pile were used through the history of the mill site to dispose of miscellaneous waste and byproduct material. The landfills, designated as north and south, required the design of specific features to divert surface water drainage away from the landfills. The north landfill is in a basalt depression; a dike was constructed at the west end to ensure drainage would be eastward through a basalt ridge. The south landfill is between two basalt ridges and drains to the east over a riprap-covered spillway constructed at the east end of the landfill. Cross sections of these landfills are in the Completion Report (ARCO 1996a). Three feet of radon cover material was placed on both landfills and the top surface was covered by 8 in. (20 cm) of topsoil, which was seeded with native grasses.

Disposal area no. 1 is between the former plant site and the ore storage area. This disposal area received debris from decommissioning of the mill crushing and grading facilities and other reclamation debris. The area consists of three levels separated by narrow rock-covered outslopes, which are covered with a 7.5 in. (19 cm) layer of D_{50} = 2.5 in. (6 cm) riprap. The top surfaces are covered by 1.5 ft (0.45 m) of radon barrier material overlain by topsoil 8 in. (20 cm) thick and seeded with native grasses. A cross section of this disposal area is in the Completion Report (ARCO 1996a).

The asbestos disposal area is in a basalt depression between disposal area no. 1 and disposal area no. 2, which is in the south edge of the carbonate tailings pile. The asbestos-containing material (ACM) in the disposal area consisted of byproduct material and plant building debris; the disposal area was completed in 1990. The disposal area was also permitted by the State of New Mexico under the Solid Waste Regulations as a Special Waste. A 10 ft (3 m) wide spillway was cut through the basalt to allow eastward drainage of water from the surface of the bowl-like disposal area; the spillway was designed to handle a Potential Maximum Flood (PMF) storm event. The sidewalls of the depression are covered by a 6-in. (15 cm) layer of limestone riprap of D_{50} = 2.5 in. (6 cm). Approximately 12 ft (3.8 m) of radon barrier material cover the ACM in the disposal area. This barrier material includes a 6 in. (15 cm) surface layer of soil/rock matrix, which has been seeded with native grasses.

The PCB-byproduct material (BMPCB) disposal cell was constructed in 1996 in disposal area no. 1. The cell was excavated to a size that would accommodate 144 drums of BMPCB with a specified spacing between drum pallets. A minimum of 3 ft (0.9 m) of compacted clay was placed below the drum disposal chamber. A minimum of 3 ft (0.9 m) of compacted clay was also placed on the side walls of the cell.

The drums were placed on pallets with 3 or 4 drums per pallet, which were placed in the disposal cell 1 ft (0.3 m) from the cell exterior wall and 3 ft (0.9 m) from adjacent pallets. All BMPCB drums were opened and any voids were filled with a soil cement mixture of portland cement, soil, flyash, and water, and allowed to dry. No void space or liquids existed in the drums upon cell closure.

After placement in the cell, the entire cell and all interstitial spaces between and underneath the drums and pallets were filled with the soil cement mixture. The final level of soil cement was 6 to 12 in. (15 to 30 cm) above the tops of the placed drums.

The BMPCB disposal cell was constructed with a clay cap 3 ft, (0.9 m) thick and a 1.5 ft (0.45 m) thick radon barrier over the clay cap. The erosion protection layer consists of a 6 in. (15 cm) thick layer of D_{50} = 1.5 in. (4 cm) rock. Design details of the BMPCB disposal cell are in the Completion Report (ARCO 1996a).

2.4 Site Drawings and Photographs

At the completion of decommissioning and reclamation pursuant to the Decommissioning Plan, Reclamation Plan, and ACL petition, the Bluewater site as-built conditions were documented with as-built drawings, maps, baseline photographs, and aerial photographs. The baseline conditions in the Completion Report (ARCO 1996a) are the basis against which future conditions at the site will be compared and the site maintained.

2.4.1 Site Map

The Bluewater site map (Plate 1) encompasses an area within a radius of approximately 2.0 mi (3.2 km) from the center of the disposal site property. The map shows the disposal site property boundary, the main and carbonate tailings areas, other tailings areas and disposal areas, utility company right-of-ways, power transformer station, fences, entrance gate, vehicle access gates, roads inside and near the property boundary, drainage systems, monitor wells, warning signs, boundary and other survey monuments, site marker, latitude and longitude, section, township, range, principal meridian, and site coordinate system. The map has a scale of 1 in. = 500 ft (1:6,000). It covers the disposal site property and an area of at least 0.25 mi (0.4 km) outside the site property boundary.

The site map will be the base map for site inspections. After each inspection, a new inspection map normally will be prepared that shows the results of that inspection. Each site inspection map will indicate the year of the inspection and the type of inspection.

2.4.2 Site Final Topographic Map

A topographic survey of the Bluewater site and surrounding area for at least 0.25 mi (0.4 km) outside the site property was conducted immediately after completion of reclamation. The final topographic survey was conducted in accordance with the standards of the *Manual of Photogrammetry* (ASP 1980). The map has a scale of 1 in = 500 ft (1:6,000) and a contour interval of 2 ft (0.6 m) and is included as Plate 2.

2.4.3 Site As-Built Drawings and Maps

At the completion of reclamation, as-built conditions at the site were documented in final as-built drawings and maps. These drawings and maps are included in the Bluewater site Completion Report (ARCO 1996a), which is in the permanent site file.

2.4.4 Site Baseline Photographs

A photographic record of final site conditions is in the Bluewater permanent site file. These photographs are part of the site Completion Report (ARCO 1996a), and provide a visual record to complement the as-built drawings and maps. Photographs taken during various phases of the demolition and disposal of mill facilities are in the ARCO *Bluewater Mill Decommissioning Report*, (ARCO 1991b). Photographs taken during the cleanup of the windblown contamination east of the mill are in the *Windblown Contamination Cleanup Report* (ARCO 1992a). These photographs and other photographs taken prior to reclamation completion are in the permanent site file.

2.4.5 Site Aerial Photographs

Aerial photographs (some in black and white and some in color) of the Bluewater site have been taken numerous times during operation of the mill, during decommissioning, and during reclamation of the tailings piles and other disposal areas. The photographs provide a continuous record for monitoring changing conditions (e.g., erosion, vegetation, and land use) over time and are in the permanent site file. Also in the permanent site file is an aerial photograph taken immediately after completion of construction of the main tailings pile. This photograph was used to prepare the site final topographic map.

2.4.6 Site Inspection Photographs

The site will be extensively photographed on the ground by a DOE field party (during the verification and orientation inspection of the site) after reclamation at the site has been completed and after the site is transferred to the DOE. This initial set of photographs will serve as a series of baseline photographs of the site. Photographs will also be taken during subsequent annual site inspections to document current conditions, especially new or changed conditions, at the site. Comparison of current photographs with the baseline set of photographs will be useful to document steady or changing conditions at the site over time.

2.5 Ground-Water Conditions

Principal aquifers in the Bluewater site area are the San Andres, Alluvial, and Chinle. The San Andres aquifer consists of the San Andres Limestone and the underlying Glorieta Sandstone. Because the contact between these two formations is gradational and sandstone units in both formations are similar, these formations are considered as one hydrologic unit. The Alluvial aquifer consists of alluvial sediments along the ancestral course of the Rio San Jose and the overlying Bluewater Basalt, which has flowed into the low area along the ancestral Rio San Jose valley and covered the alluvial material. The Chinle aquifer is in the coarse sediments of the Sonsela Bed in the middle part of the Chinle Formation. These Chinle aquifer rocks are stratigraphically above the San Andres aquifer, crop out just to the north and northeast of the Bluewater site, and do not affect the ground water at the site. Reports on a ground-water study and a ground-water model, prepared by Dames and Moore (1984 and 1986, respectively) contain detailed descriptions of the hydrogeology of the site area, summaries of ground-water quality data, and evaluations of monitoring data. These reports are available in the site file.

The San Andres aquifer is the principal aquifer in the area and consists mainly of sandstone and a few beds of massive limestone. High transmissivity in the aquifer occurs in some places because of the effect of karst solution openings in the limestone. Transmissivity in the San Andres is much lower just east of the main tailings pile where the karst features in the uppermost part of the San Andres Limestone have been removed by erosion on the exposed hilltop. Hydrogeologic information for the monitor wells in the San Andres aquifer at the site is presented in the *CAP and ACL Petition for Uranium, Molybdenum and*

Selenium, Bluewater Uranium Mill near Grants, New Mexico (ARCO 1990a). Very low storage coefficient values and high transmissivity values for the San Andres aquifer indicate that it is generally a high-yield confined aquifer. The potentiometric surface of the San Andres shows that flow in the site area is generally eastward to southeastward (ARCO 1995a). Faults and minor folding affect ground-water movement in the San Andres. The major east-trending fault south of the main tailings pile and just south of the San Andres Limestone hill (Figure 2–5) forms a barrier and reduces ground-water flow across it. Other faults in the site area, particularly the north-trending fault beneath the main tailings pile, form barriers to flow in the San Andres aquifer. Monitoring of the major ions and other constituents by ARCO has indicated that the transport of constituents in the San Andres aquifer follows the hydraulic gradient east of the main tailings pile. There is no evidence of substantial migration of contaminants to the south of the east-trending normal fault shown in Figure 2–5.

Transmissivity of the Alluvial aquifer varies widely depending on the grain size and variable but small thickness of the alluvial material. The highest permeability of the aquifer is toward the thickest part of the erosional scour channels along the ancestral course of the Rio San Jose, where the alluvium is most coarse. Most of the alluvium is confined or semi-confined by the overlying basalt. Storage coefficient values reported for the alluvial material show that the aquifer is transitional between confined and unconfined. The overlying basalt forms a rough, permeable surface that enhances recharge by direct infiltration of precipitation through open vertical fractures down into the alluvial material. As for the San Andres aquifer, hydrogeologic information for the monitor wells in the Alluvial aquifer at the site is presented in the *CAP and ACL Petition for Uranium, Molybdenum and Selenium, Bluewater Uranium Mill near Grants, New Mexico* (ARCO 1990a).

The flow rate and direction in the Alluvial aquifer is controlled by the location of the ancestral Rio San Jose channel, which followed a sinuous path just south of the main tailings pile. The ancient channel extended along the east-trending fault line where the escarpment of more resistant San Andres Limestone represented the north or upthrown side of the fault. Basalt flowed down the channel and now marks the channel location. Ground water in alluvium in the vicinity of the main tailings pile must either flow downgradient along the narrow subsurface alluvial channel to the southeast or leak downward into the San Andres aquifer. The potentiometric surface of the Alluvial aquifer shows that flow in the site area is generally to the southeast (ARCO 1995a).

From the monitoring by ARCO, it appears that neither the main tailings pile nor constituents in the neutralization zone under the pile continue to act as a contaminant source for the Alluvial aquifer. With the decreased hydraulic head in the main tailings pile, there is insufficient head to maintain the pathway to the alluvium. Instead, what little water that does migrate from the main tailings pile would most likely percolate vertically downward to the San Andres aquifer whose transmissivity is much higher than the Alluvial aquifer. As a result, concentrations of contaminants reaching the San Andres will be more quickly diluted and attenuated than in the Alluvial aquifer.

2.6 Specific Site-Surveillance Features

Boundary monuments, warning signs, a site marker, and monitor wells are the specific site-surveillance features at the Bluewater site. These features along with their identifying symbol are listed in Table 2–3. Twenty-four boundary monuments define all corners of the legal boundary of the site property (Plate 1). Ten warning signs are posted at gates along the site boundary. Additional warning signs (42) are posted around the tailings piles and other disposal areas that contain buried radioactive material (Plate 1); the purpose of these signs is to warn humans approaching in the daylight from any direction about the areas of buried radioactive material. The one site marker is placed southwest of the main tailings pile and northwest of the carbonate tailings pile. The construction and emplacement of the boundary monuments, warning signs, and site marker are described below. Monitor wells representing background, point of compliance, and point of exposure locations for each of the two aquifers (Alluvial and San Andres), and an additional well located to detect any PCB contamination, are inside the site property at locations shown on Plate 1.

Boundary Monuments

Bernsten Federal aluminum survey monuments, Model A–1, were used for the 24 boundary monuments (Figure 2–11). Ceramic magnets are epoxied into the cap and base of each monument and are vertically oriented so that the monument can easily be found if it becomes buried. The monuments are set with the base 38 in. (97 cm) below ground surface and 10 in. (25 cm) above ground surface (Figure 2–11).

Table 2–3. Specific Site-Surveillance Features for Bluewater, New Mexico, Site

Identifier	Feature and Number
BM	Boundary Monuments, 24
P	Warning Signs, 52
SMK	Site Marker, 1
E(M), example	Monitor Wells, 9

Warning Signs

Ten warning signs along the property boundary are attached to a 2.5-in. (6 cm) diameter steel post with a concrete base set approximately 5 ft (1.5 m) inside the site boundary fence and are placed at eye level, about 5 ft (1.5 m) high. These signs around the site boundary are widely placed and are set where they are easily visible from the entrance gate and other vehicle access gates. Signs along the site boundary are numbered in counterclockwise order starting with the sign near the entrance gate. Warning signs also surround the tailings piles and other radioactive material disposal areas. These signs are attached to posts and are set in the same manner as the signs along the site boundary. The signs around the radioactive areas are set about 100 ft (31 m) outside the edge of the radioactive area. Spacing between signs is 500 ft (152 m)or less.

Warning signs are the same for both near-boundary signs and signs around radioactive material areas. Warning sign location and number are shown on Plate 1. The signs contain the following information: the name of the disposal site, the international symbol that indicates presence of radioactive material, a notice that trespassing is forbidden on this federally-owned site, and the 24-hour telephone number for the DOE–GJO. The warning signs are of the dimensions and specifications shown in Figure 2–12.

Site Marker

One unpolished granite site marker with the dimensions shown in Figure 2–13 has been installed at the Bluewater site. Site marker SMK–1 is set on the ground surface in the level area between the main tailings pile and the carbonate tailings pile (Plate 1).

The inscription on the site marker identifies the general locations of the tailings piles within the site property, the date of closure, the tonnage of tailings, and the curies of radioactivity of radium-226. The international symbol for radiation is also inscribed in the marker at the position of each tailings disposal area (Figure 2–14).

Figure 2–11. Boundary Monument at Bluewater, New Mexico, Site

Figure 2–12. Warning Sign at Bluewater, New Mexico, Site

Figure 2–13. Site Marker Design at Bluewater, New Mexico, Site

Figure 2–14. Incised Marker at Bluewater, New Mexico, Site

Monitor Wells

Nine monitor wells are inside the site property. Five of the wells are screened in the Alluvial aquifer and the other four wells are screened in the San Andres aquifer. The wells are listed by aquifer and purpose in Table 2–4; Plate 1 shows the well locations. Construction details and lithologic logs for the wells are in the reports, "Corrective Action Program and ACL Petition" (ARCO 1995a) and "*Monitoring Plan, PCB-Byproduct Disposal Facility*" (ARCO 1996d). Sampling frequency and analytes for the wells are summarized in Section 3.7, Environmental Monitoring.

Table 2–4. Monitor Wells at Bluewater, New Mexico, Site

Aquifer	**Well and Purpose**
Alluvial	E(M), Background F(M), Point of Compliance T(M), Point of Compliance X(M), Point of Exposure Y2(M), Point of Compliance for PCB Monitoring
San Andres	L(SG), Background OBS-3, Point of Compliance S(SG), Point of Compliance I(SG), Point of Exposure

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3.0 Long-Term Surveillance Program

3.1 General License for Long-Term Custody

States have right of first refusal for long-term custody of Title II disposal sites (UMTRCA, Section 202 [a]). On August 26, 1994, the State of New Mexico exercised its right of first refusal and declined the long-term custody of the ARCO Bluewater site (State of New Mexico 1994). Because the State declined this right, the site will be transferred to the DOE for long-term custody.

When the NRC accepts this LTSP and terminates ARCO's specific operating license, the site will be included under the NRC's general license for long-term custody (10 CFR 40.28 [b]). Concurrent with this action, a deed and title to the site will be transferred from ARCO to the DOE.

Although sites are designed to last "for up to 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years (40 CFR 192, Subpart A, §192.02 [a])," there is no termination of the general license for the DOE's long-term custody of the site (10 CFR 40.28 [b]).

Should changes to this LTSP be necessary, the NRC must be notified of the changes, and the changes may not conflict with the requirements of the general license. Additionally, the NRC must be guaranteed permanent right-of-entry for the purpose of periodic site inspections.

3.2 Requirements of the General License

To meet the requirements of the NRC's license at 10 CFR 40.28 and Appendix A, Criterion 12, the DOE, as long-term custodian, must, at a minimum, fulfill the following requirements. The section in the LTSP in which each requirement is addressed is given in parentheses.

1. Annual site inspection. (Section 3.3)

2. Annual inspection report. (Section 3.4)

3. Follow-up inspections and inspection reports, as necessary. (Section 3.5)

4. Site maintenance, as necessary. (Section 3.6)

5. Emergency measures. (Section 3.6)

6. Environmental monitoring. (Section 3.7)

3.3 Annual Site Inspections

3.3.1 Frequency of Inspections

At a minimum, the site must be inspected annually by DOE to confirm site integrity and to determine the need, if any, for maintenance or monitoring (10 CFR 40, Appendix A, Criterion 12).

To meet this requirement, the DOE will inspect the Bluewater site once each calendar year. The date of the inspection may vary from year to year, but the DOE will endeavor to inspect the site approximately once every 12 months unless circumstances warrant variance. Any variance to this inspection frequency will be explained in the inspection report. The DOE will notify the NRC and the State of New Mexico of the inspection at least 30 days before the scheduled inspection date.

3.3.2 Inspection Procedure

For the purposes of inspection, the Bluewater site will be divided into sections, called transects. Each transect will be individually inspected. Proposed transects for the first inspection of the Bluewater site are listed in Table 3–1 and shown in Figure 3–1.

Table 3–1. Transects Used During First Inspection of Bluewater, New Mexico, Site

Transect	Description
Site Perimeter and Outlying Areas	Site boundary and outlying areas up to 0.25 mi (0.4 km) outside the property boundary. Includes the property fence, perimeter warning signs, site entrance gate and access easement, boundary monuments, and perimeter access gates for utility right-of-ways.
Tailings Piles and Other Disposal Areas	Main and carbonate piles, other disposal areas, and the perimeter warning signs around them. Includes the site marker.
Utility Company Right-of-Ways and Facilities	Fences and gates associated with utility company right-of-ways and power transformer station.
Other Features and Areas Within Site Property	Includes access roads and monitor wells.

The area within each transect will be generally inspected for evidence of slumping, settlement, wind or water erosion, and human, plant, or animal intrusion. The condition of disposal area cover and riprap and the health and success of revegetation efforts will be evaluated. Within each transect, the condition of specific site-surveillance features (Section 2.6), such as the site marker, warning signs, monitor wells, and boundary monuments, will be individually inspected for change, deterioration, and other effects such as vandalism. The entire perimeter fence will be inspected for integrity and deterioration.

In addition to inspection of the site itself, inspectors will note changes and developments in the area surrounding the site, especially changes within 0.25 mi (0.4 km) of the site perimeter. Significant changes within this area could include development or expansion of mining, human habitation, erosion, road building, or other change in land use.

It may be necessary to document certain observations with photographs. Such observations may be evidence of vandalism, ponded water, or a slow modifying process, such as rill erosion, that should be monitored more closely than general site conditions. A sample Field Photograph Log is included in Appendix D.

3.3.3 Inspection Checklist

The inspection is guided by the inspection checklist. The initial site-specific inspection checklist for the Bluewater site is in Appendix E.

The inspection checklist includes discussion on the preparation for the inspection, health and safety concerns, and the performance of the inspection itself.

Figure 3–1. Map of Inspection Transects for Bluewater, New Mexico, Site

The checklist is subject to revision. At the conclusion of an annual site inspection, inspectors will note revisions to the checklist, if necessary, in anticipation of the next annual site inspection. Revisions to the checklist will include such items as new discoveries or changes in site conditions that must be inspected and evaluated during the next annual inspection. Other revisions will include updating of telephone numbers and directions to local medical facilities as part of the health and safety precautions noted in the checklist.

3.3.4 Personnel

Annual inspections will normally be performed by a minimum of two inspectors. Inspectors will be experienced engineers and scientists who have been specifically trained for the purpose by participation in previous site inspections.

Engineers will typically be civil, geotechnical, or geological engineers. Scientists will include geologists, hydrologists, biologists, and environmental scientists representing various fields (e.g., ecology, soils, range management). If particular problems develop at the site, more than two inspectors may be assigned to the inspection at DOE’s discretion. Inspectors specialized in specific fields may be assigned to the inspection to evaluate serious or unusual problems and make appropriate recommendations.

3.4 Annual Inspection Reports

Results of annual site inspections will be reported to the NRC within 90 days of the last site inspection in that calendar year (10 CFR 40, Appendix A, Criterion 12). In the event that the annual report cannot be submitted within 90 days, the DOE will notify the NRC of the circumstances.

3.5 Follow-up Inspections

Follow-up inspections are unscheduled inspections that may be required (1) as a result of discoveries during a previous annual site inspection, or (2) as a result of changed site conditions reported by a citizen, employee, or federal, state, or local agency.

3.5.1 Criteria

Criteria for follow-up inspections are required by 10 CFR 40.28 (b)(4). The DOE will conduct follow-up inspections should the following occur.

1. A condition is identified during the annual site inspection, or other site visit, that requires personnel, perhaps personnel with specific expertise, to return to the site to evaluate the condition.

2. The DOE is notified by a citizen, employee, or federal, state, or local agency that conditions at the site are substantially changed.

Once a condition or concern is identified at the site, the DOE will evaluate the information, and, on the basis of this evaluation, will decide to respond with a follow-up inspection.

Conditions that may require a routine follow-up inspection include changes in vegetation, slope stability, new or increased erosion, evidence of casual or low-impact human intrusion, minor vandalism, or the need to revisit the site to evaluate, define, or perform maintenance tasks. Conditions that may require a more immediate (nonroutine) follow-up inspection include extreme weather or seismic events and disclosure of deliberate human intrusion that threatens the integrity of the disposal cell.

The DOE will act responsibly, but will exercise flexibility and a graded approach in scheduling routine follow-up inspections. Urgency of the follow-up inspection will be in proportion to the seriousness of the condition. For example, a follow-up inspection to investigate a vegetation problem may be scheduled for a particular time of year when growing conditions are optimum. A routine follow-up inspection to perform maintenance or to evaluate an erosion problem might be scheduled to avoid snow cover or frozen ground.

In the event of "unusual damage or disruption" (10 CFR 40, Appendix A, Criterion 12) that threatens or compromises site safety, security, or integrity, including the unlikelihood of an actual breach in cover materials, the DOE will notify the NRC, begin the DOE occurrence notification process (DOE Order 232.1), respond with an immediate follow-up inspection, and begin emergency measures (Section 3.6) to contain or prevent dispersion of radioactive materials from the disposal cell. At any time, the DOE may request the assistance of local authorities to confirm the seriousness of a condition at the site before scheduling a follow-up inspection or initiating other appropriate action.

The DOE has established liaison with other government agencies for notification in the event of human intrusion or unusual-to-catastrophic natural events in the vicinity of the site. The Cibola County Sheriff's Department in Grants; the U.S. Geological Survey National Earthquake Information Center in Denver, Colorado; and the New Mexico Area Office of the National Weather Service in Albuquerque. These agencies will either contact the DOE or, in the case of the weather service, broadcast the area warnings, should an event occur that might affect the security or integrity of the Bluewater site. Agency notification agreements are in Appendix F.

In addition, warning signs installed at access points along the site boundary and around the tailings piles and other disposal areas display a 24-hour DOE–GJO telephone number. The public may use this number to request information about the site or to advise the DOE of problems at the site. The DOE may conduct follow-up inspections in response to information provided by the public.

3.5.2 Personnel

Inspectors assigned to follow-up inspections will be selected on the same basis as for the annual site inspection. (See Section 3.3.4.)

3.5.3 Reports of Follow-up Inspections

Results of routine follow-up inspections will be included in the next annual inspection report (Section 3.4). Separate reports will not be prepared unless the DOE determines it advisable to notify the NRC or other outside agency of a problem at the site.

If follow-up inspections are required for more serious or emergency reasons, the DOE will submit to the NRC a preliminary report of the follow-up inspection within the required 60 days (10 CFR 40, Appendix A, Criterion 12).

3.6 Routine Site Maintenance and Emergency Measures

3.6.1 Routine Site Maintenance

UMTRCA disposal sites are designed and constructed so that "ongoing active maintenance is not necessary to preserve isolation" of radioactive material (10 CFR 40, Appendix A, Criterion 12). The tailings piles and other disposal areas were designed and constructed to minimize the need for routine maintenance. Parts of the site that were excavated and recontoured and the top slopes of several of the disposal areas were revegetated with self-sustaining native grass species. Establishment of this vegetative cover during the first several years after construction completion is necessary to prevent wind and water erosion. If drought conditions prevent the establishment of the vegetative cover, maintenance in the form of reseeding may be required. The long perimeter of the site property and the utility right-of-ways inside the site property are fenced with a 4-strand barbed-wire fence to prevent livestock grazing. Some livestock and wildlife entry to the site will occur and fence repair and maintenance will be conducted as necessary to maintain the integrity of the fences. The DOE will perform routine site maintenance, where and when needed, based on best management practices. Reports of routine site maintenance will be summarized in the annual site inspection report.

3.6.2 Emergency Measures

Emergency measures are the actions the DOE will take in response to "unusual damage or disruption" that threaten or compromise site safety, security, or integrity. The DOE will contain or prevent dispersal of radioactive materials in the unlikely event of an actual breach in cover materials.

3.6.3 Criteria for Routine Site Maintenance and Emergency Measures

Conceptually, there is a continuum in the progression from annual minor routine maintenance to large-scale reconstruction of the disposal cell following a disaster. Criteria, although required by 10 CFR 40.28 (b)(5), for triggering particular DOE responses for each progressively more serious level of intervention are not easily defined because the nature and scale of all potential problems can not be foreseen. The information in Table 3–2 will, however, serve as a guide for appropriate DOE responses. The table shows that the difference between routine maintenance and emergency responses is primarily one of urgency and degree of threat or risk. The DOE's priority (urgency) in column 1 of Table 3–2 bears an inverse relationship with the DOE's estimate of probability. The highest priority response is also believed to be the least likely to occur.

3.6.4 Reporting Maintenance and Emergency Measures

Routine maintenance completed during the previous 12 months will be summarized in the annual inspection report. In accordance with 10 CFR 40.60, the DOE will notify the Uranium Recovery Branch, the Division of Waste Management, the Office of Nuclear Material Safety and Safeguards, and the NRC within 4 hours of discovery of any Priority 1 or 2 event in Table 3–2. The phone number for the required 4-hour contact to the NRC Operations Center is in the Inspection Checklist (Appendix E).

Table 3–2. DOE Criteria for Maintenance and Emergency Measures[a]

Priority	Description	Example	Response
1	Breach of disposal cell with dispersal of radioactive material	Failure of side slope of disposal cell	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to prevent further dispersal, recover radioactive materials, and repair breach
2	Breach without dispersal of radioactive material	Partial or threatened exposure of radioactive materials	Notify NRC. Immediate follow-up inspection by DOE emergency response team. Emergency actions to repair the breach
3	Breach of site security	Human intrusion, vandalism	Restore security; urgency based on assessment of risk
4	Maintenance of specific site surveillance features	Deterioration of monitor wells and boundary monuments	Repair at first opportunity
5	Minor erosion or undesirable changes in vegetation	Erosion not immediately affecting disposal cell, invasion of undesirable plant species	Evaluate, assess impact, respond as appropriate to eliminate problem

[a]Other changes or conditions will be evaluated and treated similarly on the basis of perceived risk.

3.7 Environmental Monitoring

3.7.1 Ground-Water Monitoring

Ground-water monitoring will be conducted at the Bluewater disposal site using the existing nine monitor wells as sample points. The monitor well name and purpose, constituents to be sampled, sampling frequency, and aquifer in which they are completed are shown in Table 3–3. The locations of the wells are shown on Plate 1 and Plate 2.

Table 3–3. Ground-Water Monitoring Information

Name, Purpose	Constituents	Frequency	Aquifer
E(M), Background	U-nat., Mo, Se, PCBs	Annually	Alluvial
Y2(M), POC	PCBs	Annually	Alluvial
T(M), POC	U-nat., Mo, Se, PCBs	Annually	Alluvial
F(M), POC	U-nat, Mo, Se, PCBs	Annually	Alluvial
X(M), POE	U-nat, Mo, Se, PCBs	If limits are exceeded at POC	Alluvial
L(SG), Background	U-nat. and Se	Every 3 years	San Andres
S(SG), POC	U-nat. and Se	Every 3 years	San Andres
OBS-3, POC	U-nat. and Se	Every 3 years	San Andres
I(SG), POE	U-nat. and Se	If limits are exceeded at POC	San Andres

The ground-water monitoring for PCB detection is as described in the EPA-approved monitoring plan for the PCB-byproduct disposal facility (ARCO 1996e). The plan includes annual sampling of the designated wells, sample analysis, and maintenance of sampling and analysis records. The EPA will be provided with a copy of the annual PCB sampling results. All PCB sampling by DOE will be discontinued after 20 years.

If PCBs are detected in any of the samples analyzed for PCBs, the DOE will inform ARCO of the occurrence as soon as practical and ARCO will conduct appropriate follow-up action in accordance with the Indemnification Agreement (Appendix G).

Ground-water monitoring for the ACL constituents of natural uranium, molybdenum, and selenium will be for evaluating continued compliance as established in the ACL petition, which is approved by the NRC as license amendment number 30.

Sampling for the ACL constituents in the background and point of compliance (POC) wells completed in the San Andres formation is planned for 1998, 2001, and 2004. The point of exposure (POE) wells will not be sampled routinely. Annual sampling for the ACL constituents is planned for the background and POC wells completed in the alluvial aquifer. After six annual samples (1997 - 2002), the sampling will follow the sample schedule as the sampling of the San Andres wells. Sampling of the POE wells will only take place if an ACL is exceeded at a POC well. After sampling in 2004, the DOE will reevaluate the sampling frequency based on the results and may propose to the NRC to reduce the sampling frequency if the conditions warrant.

If an ACL is exceeded at a POC well, the DOE will inform NRC of the exceedance, conduct confirmatory sampling of the POC wells, and sample the POE wells. If the confirmatory sampling verifies the exceedance, the DOE will develop an evaluative monitoring work plan and submit that plan to the NRC for review prior to initiating the evaluative monitoring program. Results of the evaluative monitoring program will be used, in consultation with the NRC, to determine if corrective action is necessary.

Table 3–4. Alternate Concentration Limits for Constituents at POC Monitor Wells

POC Well	Constituent	ACL
T(M)	U-natural Molybdenum Selenium	0.44 mg/L (300 pCi/l) 0.10 mg/L 0.05 mg/L
F(M)	U-natural Molybdenum Selenium	0.44 mg/L (300 pCi/l) 0.10 mg/L 0.05 mg/L
S(SG)	U-natural Selenium	2.15 mg/L 0.05 mg/L
OBS-3	U-natural Selenium	2.15 mg/L 0.05 mg/L

3.7.2 Vegetation Monitoring

The disturbed areas of the disposal site were revegetated following remediation. Annual visual inspections will be performed to evaluate progress of the revegetation. Ideally, the vegetation will establish itself with a density that equals the density of the native perennial species in the immediate area. Should reseeding become necessary, ARCO’s post-remediation seed mix will be used.

3.8 Records

The LTSM Program maintains site records in a permanent site file at the DOE–GJO. These records are available for inspection by government agencies or the public.

All LTSM Program records are maintained in full compliance with DOE requirements:

1. DOE Order 1324.2A, Records Disposition

2. DOE Order 1324.5, Records Management Program

3. DOE Order 1324.8, Rights and Interests Records Protection Program

4. DOE Order 5500.7B, Emergency Operating Records

3.9 Quality Assurance

The long-term custody of the Bluewater site and all activities related to the annual surveillance and maintenance of the site will comply with DOE Order 5700.6C, Quality Assurance (QA), and the draft "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (American Society for Quality Control 1994).

QA requirements will be transmitted through procurement documents to subcontractors when appropriate.

3.10 Health and Safety

Health and safety procedures for LTSM Program activities are consistent with DOE orders, regulations, codes, and standards.

Immediate health and safety concerns are listed in the Inspection Checklist (Section 3.3.3 and Appendix E). Also in the Health and Safety section of the Inspection Checklist are 24-hour emergency phone numbers for fire, hospital and ambulance, and police and sheriff; directions from the site to the nearest hospital with an emergency room are also included. The checklist is updated before each inspection to advise on-site personnel of new and continuing health and safety considerations. A Job Safety Analysis is prepared before each inspection and is presented as part of a prerequisite-inspection briefing held several days before the inspection. At the briefing, personnel who will be on the site review the Job Safety Analysis and are instructed on hazards that may be present at the site and health and safety procedures that must be followed.

Subcontractors (for maintenance) are advised of health and safety requirements through appropriate procurement documents. Subcontractors must submit health and safety plans for all actions subject to Occupational Safety and Health Administration (OSHA) requirements. Subcontractor health and safety plans will be reviewed and approved before the contract is awarded. Proposals from subcontractors without an adequate health and safety plan will be rejected.

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Appendix A
Legal Description of Site Property Boundary

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Appendix B
Contact Information for Landowners Adjacent to the Site and for Utility Companies Whose Easements Cross the Site Property

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LANDOWNERS ADJACENT TO THE BLUEWATER SITE		
NAME	**ADDRESS**	**PHONE**
U.S. Department of Interior Bureau of Land Management	New Mexico State Office 1474 Rodeo Road P.O. Box 27115 Santa Fe, NM 87502-0015	(505) 438-7400
	Rio Puerco Resource Area Office Hector Villalobos 435 Montano Road N.E. Albuquerque, NM 87107	(505) 761-8704
Berryhill Ranch Limited	c/o Duane Berryhill 7000 W. Highway 66 Bluewater, NM 87005	(505) 876-2597
State of New Mexico	Bataan Memorial Building Santa Fe, NM 87501	(505) 287-8113
Homestake Mining Company	650 California Street San Francisco, CA 94108	(415) 981-8150
UTILITY COMPANIES WHOSE EASEMENTS CROSS THE BLUEWATER SITE		
NAME	**ADDRESS**	**PHONE**
Transwestern Pipeline Company	4001 Indian School Road, N.E. Albuquerque, NM 87110	(505) 260-4000
Plains Electric Generation and Transmission Cooperative, Inc.	2401 Aztec Road, N.E. Albuquerque, NM 87107	(505) 889-7200
El Paso Natural Gas Company	3801 Atrisco Drive, N.W. Albuquerque, NM 87105	(505) 831-7700
Continental Divide Electric Cooperative, Inc.	200 E. High Street Grants, NM 87020	(505) 285-6656

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Appendix C
Legal Description of Utility Company Right-of-Ways Across Site Property

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Appendix D
Field Photograph Log

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FIELD PHOTOGRAPH LOG

Site: ____________________________ Roll No.__ (of __) Page 1

Date: _________________ Time of Day: Fm ______ To _______

Weather Conditions: ____

Film Data: Size ___ ISO ___ Exposures ___

Frame[a]	Azimuth[b]	PL No.[c]	Subject/Description
0	_______	______	________________________
1	_______	______	________________________
2	_______	______	________________________
3	_______	______	________________________
4	_______	______	________________________
5	_______	______	________________________
6	_______	______	________________________
7	_______	______	________________________
8	_______	______	________________________
9	_______	______	________________________
10	_______	______	________________________
11	_______	______	________________________
12	_______	______	________________________
13	_______	______	________________________
14	_______	______	________________________
15	_______	______	________________________
16	_______	______	________________________
17	_______	______	________________________

Inspector: ____________________________ ____________________________

Signature Printed Name

[a]Adjusted to match frame number on negative.
[b]Declination angle: ____
[c]Photograph location number. Assigned when inspection report is written. See inspection report, Plate 1, for map of photograph locations.

FIELD PHOTOGRAPH LOG

Site: ______________________________ Roll No.__ (of __) Page 2

Date: _______________ Time of Day: Fm ______ To _______

Weather Conditions: ____

Film Data: Size ___ ISO ___ Exposures ___

Frame[a]	Azimuth[b]	PL No.[c]	Subject/Description
18	_______	______	________________________________
19	_______	______	________________________________
20	_______	______	________________________________
21	_______	______	________________________________
22	_______	______	________________________________
23	_______	______	________________________________
24	_______	______	________________________________
25	_______	______	________________________________
26	_______	______	________________________________
27	_______	______	________________________________
28	_______	______	________________________________
29	_______	______	________________________________
30	_______	______	________________________________
31	_______	______	________________________________
32	_______	______	________________________________
33	_______	______	________________________________
34	_______	______	________________________________
34	_______	______	________________________________
34	_______	______	________________________________

Inspector: ________________________ ________________________

Signature Printed Name

[a]Adjusted to match frame number on negative.
[b]Declination angle: ____
[c]Photograph location number. Assigned when inspection report is written. See inspection report, Plate 1, for map of photograph locations.

Appendix E
Initial Site Inspection Checklist

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Inspection Checklist
Annual Site Inspection

Site: Bluewater, New Mexico, Title II Disposal Site

Date Prepared:

Date of Inspection:

Type of Inspection: First Annual Inspection

I. General Instructions

A. This inspection checklist is site specific. It incorporates general and site-specific requirements for annual inspections of the subject site.

This checklist may be revised in response to new requirements, as dictated by results of previous inspections and maintenance requirements, or as new information about the site is received.

B. The purpose of the checklist is to support

- Planning for the inspection
- Inspection of the site
- Evaluation of the thoroughness of the inspection before the inspection party leaves the site at the conclusion of the inspection
- Preparation of the inspection report

C. This checklist is provided for the convenience of those planning and conducting the inspection. Other information, materials, or guidance may be used in place of or in addition to the checklist if site conditions or institutional requirements require.

II. Preparation for the Inspection

A. Review inspection guidance documents:

- "Guidance for Implementing the Long-Term Surveillance Program for UMTRA Project Title I Disposal Sites (DOE 1996).
- *Long-Term Surveillance Plan for the DOE Bluewater (UMTRCA Title II) Disposal Site Near Grants, New Mexico,* draft (this report)

B. Review previous inspection reports, field notes from previous inspections, maps and drawings of the site, and other documents as necessary to become familiar with site history, current conditions at the site, and the results of recent inspections and maintenance. Obtain copies of maps, plans, and other documents required for the inspection:

- Long-Term Surveillance Plan (LTSP)
- Pertinent documents from the Site File, such as the Completion Report submitted by Atlantic Richfield Company (ARCO)

Review site access procedures and protocols. Complete actions required to enter the site.

Notify affected agencies.

Obtain key for lock on gates from:

- DOE–Grand Junction Office Mr. J. Virgona 970-248-6006

C. Review specific observations to be made and problems to be studied or resolved during the coming inspection. (See Subsection E of this Section.)

D. Assemble and pack field equipment required for the inspection of the Bluewater site:

- Camera
- Spare batteries
- Camera accessories
- Film, three rolls of 36-exposure (or equivalent) color print film
- Photograph scale/north arrow
- Brunton compass
- 50-foot tape
- 10- to 20-foot tape
- Gate keys
- Covered clipboard
- Canteens or other provision for water in hot weather
- Sun protection
- Field photograph forms

- Hand-held level
- Orange field notebook
- Black, indelible, felt-tip marker with broad point
- Day packs or belt packs (optional but advisable for this site)
- Bolt cutters
- First aid kit

E. General Surveillance

1. Specific Site-Surveillance Features
    - Access road
    - Entrance gate
    - Property boundary fence and right-of-way access gates
    - Boundary monuments, 24
    - Warning signs around the site property boundary 10
    - Warning signs around the tailings disposal areas, 42
    - Site marker
    - Monitor wells, 9
2. Transects
    - Site property boundary and outlying areas up to 0.25 mi (0.4 km) outside the site property
    - Tailings piles and other disposal areas and the warning signs around them
    - Utility company right-of-ways and facilities and associated fences and gates
    - Other features and areas within the site property boundary

For all transects:

- Settlement, slumping, heaving, cracking
- Wind or water erosion
- Windblown sand accumulation

- Invasion by plants or animals
- Intrusion by humans or domestic animals
- Other

3. Area Within 0.25 mi (0.4 km) of the site
   - Change in land use
   - New construction or development
   - Earth movement, erosion, or changes in nearby drainages
4. Specific Tasks and Observations
   - (These will vary depending on the condition of the site and on issues or concerns developed from previous inspections.)
5. Maintenance

III. Site Inspection

A. The checklist is not intended to be exhaustive or constraining. The inspection team is free to make other observations as its judgment and site conditions warrant.

B. Before the inspection of the site is completed and before the inspection team leaves the site, the inspection team should satisfy itself that the site has been fully inspected and evaluated and that sufficient photographs and measurements have been obtained.

C. Health and Safety

The Bluewater site is usually hot and dry in summer and cold and dry in winter. Occasional thunderstorms occur in late summer and light snows occur in winter. Personnel should make provisions for the following seasonal conditions:

Summer:

- Sun protection (a hat is advised).
- Drinking water. Personal canteens recommended, 2 quarts per person.
- Rain gear.

Winter:

- Warm clothing, preferably layered.

Safety shoes are not required at this site. However, side slopes and top of the main tailings pile and carbonate tailings pile are covered with angular, unstable basalt, and sturdy boots with high ankle support are essential. Rattlesnakes inhabit areas of rugged malpais, and these areas should be avoided.

Emergency contacts and phone numbers for the Bluewater site are as follows:

- Emergency Medical Service/Ambulance
  Cibola General Hospital in Grants, New Mexico
  Phone 505-287-4446 for hospital and 505-287-7446 or 911 for ambulance

- Fire
  Phone 505-876-4942 or 911 for Fire Department in Bluewater, New Mexico
  505-287-3776 or 911 for Fire Department in Milan, New Mexico

- Sheriff/Police
  Phone 505-287-9476 or 911 for Cibola County Sheriff
  505-287-4141 or 911 for New Mexico State Police

The nearest telephone is in a store/restaurant at the Bluewater entrance to Interstate 40 approximately 2 mi northwest on State Highway 122 from the turnoff to the former ARCO Bluewater Mill.

Directions from the site to Cibola General Hospital are as follows:

From the turnoff to the former ARCO Bluewater Mill on State Highway 122, proceed about 9 mi southeast on State Highway 122 through Milan and into Grants. Turn left (north) on 1st St (State Highway 547) and continue 1.9 mi to Roosevelt Avenue. Turn right (east) on Roosevelt and go 0.8 mi to Cordova Avenue. Turn left on Cordova and Emergency Hospital Entrance is about 1 block on the left.

IV. Inspection Closeout Summary

A. At the end of the inspection and before leaving the site, the inspection team should:

1. Satisfy itself that it has sufficient information (photographs, notes, measurements, sketches, etc.) to describe and evaluate findings and observations for the site inspection report.

2. Summarize, in the field notes or elsewhere, the following information:

   - Serious problems or threatening factors that require immediate attention or follow-up action;

   - Actual or potential problems not requiring immediate attention but that require further observation possibly including a follow-up inspection; and

   - Changes recommended for this checklist before the next inspection.

B. If serious problems are identified during the inspection, the inspection team should:

1. Immediately notify the DOE–GJO Project Manager and the LTSM Project Manager.

2. Follow GJO procedures for compliance with DOE Order 232.1 (DOE 1995).

3. In the event of a release (excursion) of radioactive material, reporting requirements in 10 CFR 40.60 will be followed. Initially within 4 hours after discovery, the NRC Operations Center will be contacted at (301) 951–0550.

Appendix F
Agency Notification Agreements

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Appendix G
Indemnification Agreement
on Disposal of PCB-Contaminated Mill Waste

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